Claims

1. A family of modular, transverse flux, rotary electric machines, each machine (12) comprising:

a rotatable shaft (21);

a plurality of identical, generally cylindrical, transverse flux rotor/stator modules (28-30) disposed on said shaft, lines of flux (79) between (68) the rotor and the stator of said modules being perpendicular to said torque, at least one of said modules being contiguous with at least one other of said modules adjacent thereto, each said module capable of contributing substantially the same rated torque to said shaft, the rated torque of said motor thereby equaling the rated torque of each said module times the number of said modules;

a rotatably driven member (17) disposed for rotation with said shaft; and

a plurality of end plates (13, 14), one for each side of any of said modules (28, 30) which side is not contiguous with another of said modules;

characterized by:

each of said machines including at least one brake (49) formed compatibly with said modules and disposed between one of said sides not contiguous with another of said modules and the corresponding one of said end plates (14);

at least one of said machines having a different number of said modules than at least one other of said machines; and

the length of said shaft being selected to accommodate at least said number of said modules, said brake, and said driven member.

2. A family of modular, transverse flux, rotary electric machines, each machine (12) comprising:

a rotatable shaft (21);

a plurality of identical, generally cylindrical, transverse flux rotor/stator modules (28-30) disposed on said shaft, lines of flux (79) between (68) the rotor and the stator of said modules being perpendicular to said torque, at least one of said modules being contiguous with at least one other of said modules adjacent thereto, each said module capable of contributing substantially the same rated torque to said shaft, the rated torque of said motor thereby equaling the rated torque of each said module times the number of said modules; and

a rotatably driven member (17) disposed for rotation with said shaft;

characterized by:

at least one of said machines having a different number of said modules than at least one other of said machines;

the length of said shaft being selected to accommodate at least said number of said modules and said driven member, said modules mounted on one or more sides of said driven member.

3. A family of machines according to claim 2 wherein:

at least one of said machines has all of said modules disposed only on one side of said driven member.

4. A family of machines according to claim 2 wherein:

at least one of said machines has at least one module disposed on each side of said driven element.

5. A modular rotary, transverse flux, electric machine (12), comprising:

a rotatable shaft (21);

a plurality of identical, generally cylindrical, transverse flux rotor/stator modules (28-30) disposed on said shaft, lines of flux (79) between (68) the rotor and the stator of said modules being perpendicular to said torque, at least one of said modules being contiguous with at least one other of said modules adjacent thereto, each said module capable of contributing substantially the same rated torque to said shaft, the rated torque of said motor thereby equaling the rated torque of each said module times the number of said modules;

a rotatably driven member (17) disposed for rotation with said shaft; and

a plurality of end plates (13, 14), one for each side of any of said modules (28, 30) which side is not contiguous with another of said modules;

characterized by the improvement comprising:

a brake (49) formed integrally with said modules and disposed between one of said sides not contiguous with another of said modules and the corresponding one of said end plates (14).

6. A machine according to claim 5 wherein said brake comprises:

one or more coils (86, 87) for disengaging said brake when they are energized;

a brake disk (43), having friction brake pads (92, 93) on each major surface thereof, disposed for rotation with said shaft and axially slidable (46, 47) on said shaft;

a frame (50) having an annular groove for said one or more coils and keyed (84) to a stationary part (60) of said machine so as to not rotate, but slide axially (83); and

at least one spring (53) to force said frame toward said end plate in the absence of said one or more coils being energized, thereby causing one of said pads to engage said end plate and the other of said pads to engage said frame, thereby providing braking torque.

7. A method of providing a family of modular rotary electric machines (12), characterized by:

(a) selecting a torque increment;

(b) designing a cylindrical transverse flux rotor/stator module (38, 40) to provide torque equal to said increment, lines of flux (79) between (68) the rotor and the stator of said module being perpendicular to an axis of said module;

(c) for each machine to be built:

(i) selecting a shaft (21) to mount the number, N, of modules needed to reach, or exceed by less than said increment, the torque required for said machine and the member (17) to be driven;

(ii) mounting said member to be driven on said shaft, and mounting said modules on said shaft contiguously, said modules mounted on one or more sides of said driven member; and

(d) at least one of said machines having a number of modules different from the number of modules in at least one other of said machines.

8. A method according to claim 7 further comprising:

designing a brake module (49) having a generally cylindrical configuration of diameter no greater than that of said modules; and

mounting said brake member on said shaft contiguously with one of said modules (30).

9. A method according to claim 7 further comprising:

selecting a number of phases, P, of drive current for said modules, where $P = NX$ and X = a small, whole, positive integer; and

said step (ii) comprises mounting said modules with proper mutual orientation for said number of phases.